Mid-Quarter Examination

Due: In 45 minutes.

Course: CS 3321, Winter 1996.

Instructions:

1. This test is designed to be a closed book examination. However, you can use your text book and class-notes if you like. Please do not use any other book or document.
2. There are three questions in this paper besides Question 0. Please use the space provided (below the questions) to write the answers. You can use the backside of pages as well. Budget your time to answer various questions to avoid spending too much time on a particular question.

Score Table					
Question	Q0	Q1	Q2	Q3	Total
Score					

QUESTION 0 (2 points) Fill out the following table.

NAME:	
UMN Identification Number:	
Account on itlabs.umn.edu :	
Recitation Section:	1 / 2 / 3/ 4/ 5/ 6
TA:	Dan S. Li/ Jung-Yong Lee/ Badrul M. Sarwar / YueWei Wang
Classification:	NTU / UNITE / Extension/ Regular

Q 1. (20 Points) Consider the "tank" class and the main() program given below. Use the class declaration and the program code to answer the following questions:

```
typedef  enum { ERR, OK } Flag; // declare enumerated type named Flag
class tank {
  private:      int capacity;  // The maximum amount tank can hold.
    int current_amount;   // The current amount in the tank.
  public:      tank( void ) {capacity = 100; current_amount = 25;}
    tank(int init, int amount) {capacity = init; current_amount = amount;}
    tank(tank tank1, tank tank2); // create a tank to contain stuff from both tank1 and tank2,
                  // capacity of the new tank is the sum of capacities of tank1 and tank2
    Flag add(int amount);  // Add material to tank. ERR if inadequate capacity.
    Flag extract(int amount);  // Remove material from tank. ERR if inadequate current_amount.
    void print(void) const; // Print data members of the tank  on a new line
};
main() {
  tank t1; tank t2(200, 10); tank t3 = t2; tank t4(t2, t3);
  t1.print();  t2.print();   t4.print();
  if (t1.add(100) == ERR) cout << "Nothing added to tank t1!" << endl;
  if (t4.add(100) == ERR) cout << "Nothing added to tank t4!" << endl;
  t1.print();   t3.print();   t4.print();
}
```

A. The member function "void print(void) const;" can change/update _____.
(a) its parameters (b) data members (c) cin, cout and cerr (d) local variables (e) none of these.

B. Right after the declarations of t1, t2, t3 and t4 in main(), the object corresponding to the tank with largest capacity is _____.
(a) t1 (b) t2 (c) t3 (d) t4

C. Right after the declarations of t1, t2, t3 and t4 in main(), the object corresponding to the tank with largest current_amount is _____.
(a) t1 (b) t2 (c) t3 (d) t4

D. A C++ statement that allows main() to print tank t1 is _____ .
(a) cout << capacity << current_amount; (b) cout << t1.capacity << t1.current_amount;
(c) cout << t1.print(); (d) cout << t1; (e) none of the previous choices.

E. Which C++ statement can be used by tank::print() to display the contents of an instance? _____.
(a) cout << capacity << current_amount; (b) cout << t1.capacity << t1.current_amount;
(c) cout << t1.print(); (d) cout << t1; (e) none of the previous choices.

F. Error checking is carried out by the member functions "add" and "extract". What would be the reasonable pre-conditions to check for in these methods?

G. Two constructors "tank::tank(void)" and "tank::tank(int init, int amount)" can be combined into one. Write down the function header for the combined one:

H. What is the output of the main program :

Q2. (13 points) I have a simple method of learning terminology (vocabulary words) for a new subject. I write the words down on a list of flash cards in alphabetic order. I then go through the cards one at a time. If I get a word right, that card is discarded. If I get it wrong, the card goes to the backend of the deck to revisit the word after the remaining words.

Write a class named "flash-card" to implement the main ADT, but not the entire software, needed by this system using the following information:

```
struct single_card {    String word;    // A term from the subject area
                        String question;       // A question about the word
                        String answer;  // Meaning and usage of the word
};
void flash_card::flash_card( single_card card_collection[], int numCards ); // constructor
void flash_card::next( single_card &next_card ); // get the next card
void flash_card::correct( void ); // The student got the correct answer
void flash_card::wrong( void ); // The student did not got the correct answer
```

Note that definition of data Members with comments are worth 1 points. Implementation of each member function with comments is worth 2 points. Test cases and correctness arguments (e.g. invariant properties of data members, pre/postconditions for member functions) are worth 4 points.

You may use language defined or user defined collection classes, which are listed on the cover of the textbook by Ford/Topp. List your assumptions.

Q3. (15 points): Compare and Contrast the following pairs of concepts. Bring out the major differences instead of simply defining the terms.

i) Member functions Vs. Global Functions

ii) C++ class Vs. Abstract Notation to specify ADTs (chapter 2)

iii) Reusing a class via Composition Vs. Reuse via Inheritance

iv) Overloading Vs. Polymorphism

v) #include file Vs. inheritance